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Remediation Program Manager
HQ AFCEE/MMR
322 E. Inner Road
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SUBJECT: AFCEE 4P F41624-03-D-8595; Task Order 0384
MMR SPEIM/LTM/O&M Program
CDRL #A001H
Fuel Spill-1 2006 Summary Letter Report

Dear Mr. Davis:

The purpose of this Summary Letter Report (SLR) is to document the results of sampling activities conducted at the Fuel Spill-1 (FS-1) plume under the System Performance and Ecological Impact Monitoring (SPEIM) program during the 2006 calendar year. This deliverable contains no detailed assessment or evaluation of the results, but is simply a means of documenting all the actions completed under the FS-1 SPEIM program. The data collected under the SPEIM program are continually assessed and the results of these assessments are presented initially during the Technical Update Meetings and then through Technical Memoranda or Project Note deliverables, if warranted, based on the results of the data evaluation or to address particular plume issues.

This letter report includes a summary of the activities performed and the data collected for the FS-1 SPEIM program between 01 January 2006 and 31 December 2006. The FS-1 plume is defined as the extent of groundwater contaminated with ethylene dibromide (EDB), the FS-1 plume contaminant of concern (COC), at concentrations exceeding the Massachusetts Maximum Contaminant Level (MMCL) of 0.02 micrograms per liter ($\mu\text{g/L}$). Lead, thallium, and toluene are COCs for the FS-1 source area groundwater. The SPEIM program is no longer monitoring source area groundwater for toluene or thallium because these analytes are no longer or have not been detected in source area groundwater samples (AFCEE 2007¹ and 2005³). It should be noted that source area wells are sampled biennially for lead (AFCEE 2007)¹ and were not sampled during this reporting period. The FS-1 extraction, treatment, and discharge (ETD) system operated between 05 April 1999 and 13 October 2002, when a fire consumed the treatment plant. This ETD system was designed to extract 750 gallons per minute (gpm) from the aquifer using one extraction well and 175 shallow wellpoints (SWP) located in the southern portion of the plume. A new ETD system was constructed and began operating on 30 September 2003. It is designed to extract 750 gpm from the aquifer using four extraction wells located in the south south-central portion of the plume. The southern most extraction well replaced the SWP system which was decommissioned in November 2003 (AFCEE 2005)³. The extracted water is conveyed to the treatment plant where it is treated by a granular activated carbon system and discharged to the K1 and K2 bog ditches via three vertical riser pipes (i.e., bubblers). The FS-1 plume and treatment system are

presented in [Figure 1](#). The Air Force Center for Environmental Excellence (AFCEE) installed the FS-1 ETD system under a Final Record of Decision (AFCEE 2000)⁵, with the selected alternative modified as described in the final wellfield design report (AFCEE 2001)⁴.

FS-1 SPEIM ACTIVITIES

The SPEIM program was developed to monitor plume changes and to ensure the effective operation of the AFCEE groundwater remediation systems at Massachusetts Military Reservation (MMR). These objectives are met through monitoring of selected media (i.e., groundwater, surface water) within and outside the plume boundaries, treatment plant monitoring, and groundwater flow and transport modeling. Activities completed for the FS-1 SPEIM program during 2006 include the following:

Standard SPEIM Sampling Activities:

- Annual (April/May 2006) and semiannual (December 2006) groundwater sampling
- Synoptic water level measurements (May 2006)
- Monthly (March 2006 through November 2006), quarterly (April 2006, July 2006, and September 2006), and semiannual (April 2006 and September 2006) surface water sampling
- Semiannual extraction well sampling (April 2006 and December 2006)
- Monthly treatment plant sampling (January 2006 through December 2006)
- Recording of daily average treatment system flow rates (January 2006 through December 2006)

The groundwater and surface water locations sampled for the FS-1 SPEIM program between January 2006 and December 2006 are presented in [Figure 2](#). Groundwater and surface water monitoring locations utilized for hydraulic monitoring during 2006 are depicted in [Figure 3](#). The well construction and surface water sample location information is included in [Table 1](#). The current approved FS-1 SPEIM network, including analytical scope and methods, is presented in the *Comprehensive Long Term Monitoring Plan*, which is available on-line at www.mmr.org under Plans and Protocols.

Groundwater analytical results are presented in [Table 2](#). [Table 3](#) contains the surface water analytical results. A map showing the distribution of EDB in groundwater is included as [Figure 4](#). Hydraulic monitoring results are included in [Table 4](#). A comparison of all compounds detected in groundwater, surface water, and treatment plant samples to applicable standards is included in [Attachment A](#).

Additional Sampling Activities

- Sampling of four FS-1 extraction wells (July 2006) to support the ETD system optimization evaluation.
- Two sediment cores were collected from the Sphagnum Bog and one from the wetland east of the K1 Bog for permeability testing.

Data Summary Report

A data summary report for all the data reported in this SLR is included on a CD in [Attachment B](#).

Presentations:

Presentations for the FS-1 plume are listed in [Table 5](#).

Project Note Submittals:

The project notes submitted for the FS-1 plume under the SPEIM program are included in [Attachment C](#).

Report Submittals:

- *Fuel Spill-1 2005 Summary Letter Report* (February 2006)
- *Draft 2005 EDB Cranberry Sampling and Analysis Technical Memorandum* (May 2006) which included the results of the 2005 cranberry sampling at the K2 and K6 bogs

Major Events and Optimizations:

A review of the groundwater EDB data collected between the startup of the final FS-1 ETD system during September 2003 and December 2006 indicated there have been significant changes in the spatial distribution of EDB in the FS-1 plume. The changes observed in the FS-1 plume were due to the operation of the FS-1 ETD system and natural attenuation. Based on these changes, a new FS-1 EDB plume shell was developed in 2006. The 2006 plume shell depicts the trailing (northern) edge of the plume approximately 1,100 feet further south, the western plume boundary is depicted approximately 150 to 200 feet eastward, the eastern boundary of the plume is depicted approximately 150 to 225 feet westward and the leading (southern) edge of the plume is depicted 160 feet northward as compared to the previous plume shell depiction in 2004 (AFCEE 2005)³. Additionally, the data indicate the upper boundary of the main body of the plume is collapsing vertically in the aquifer.

Optimization activities are completed as part of the SPEIM program in order to improve the performance of the remedial systems and to improve the monitoring program. Based on the changes in the FS-1 plume the FS-1 chemical monitoring program was optimized as detailed in Project Note: *FS-1 Monitoring Network Optimization* (included in [Attachment C](#)). The optimized FS-1 chemical monitoring program included: (1) the elimination of 31 monitoring wells, SWPs or surface water locations that no longer provided useful information; (2) the reduction in the monitoring frequency for many groundwater and surface water locations; and (3) the elimination of the monitoring of thallium at the source area wells. Additionally, the ecological impact monitoring at surface water locations 36SW0015 and 36SW0300 was eliminated from the SPEIM program because it was no longer deemed necessary.

The changes in the spatial distribution of EDB in the FS-1 plume also indicate an optimization of the FS-1 ETD system is warranted to improve the plume capture efficiency of the system. An optimization evaluation of the ETD system is currently underway and should be completed during spring 2007.

FS-1 REMEDIAL STATUS UPDATE

Analytical results from the influent and effluent sampling ports for the FS-1 plant are presented in [Table 6](#). Average weekly flow rates for the FS-1 extraction wells are presented in [Table 7](#). Treatment system operational downtimes or deviations (for events lasting two hours or longer) between January 2006 and December 2006 are summarized in [Table 8](#). Mass removal calculations through December 2006 for the FS-1 treatment plant are presented in [Table 9](#).

The most recent plume shell for the FS-1 plume included data collected through June 2006 (AFCEE 2006)². The 2006 FS-1 plume shell is estimated to contain approximately 459 million gallons of EDB contaminated groundwater and 1.15 pounds (lbs) of EDB.

The FS-1 ETD system removed approximately 0.75 lbs of EDB between January 2006 and December 2006. During this period, approximately 385 million gallons of groundwater was treated at the FS-1 treatment plant.

The FS-1 ETD system is currently operating under the design flow rates presented in the final wellfield design report (AFCEE 2001)⁴. Based on the 2004 plume shell and the current pumping conditions, groundwater transport modeling results indicate that EDB at concentrations above the Massachusetts Maximum Contaminant Level will still be present in the FS-1 plume through 2029 (AFCEE 2005)³. It should be noted that groundwater transport modeling was not performed during 2006 using the 2006 plume shell. Through the SPEIM program, remedial system operation is continuously evaluated and optimized to reduce cleanup times, therefore this timeframe will most likely be decreased in future scenarios.

FS-1 SPEIM ACTIVITIES PLANNED FOR 2007

Activities currently planned for the FS-1 SPEIM program for 2007 include the following:

- Biennial/annual (May 2007) and semiannual (October 2007) groundwater sampling
- Surface water sampling during the 2007 cranberry growing season (March 2007 through October 2007)
- FS-1 SPEIM data presentation for biennial/annual (May 2007) sampling round
- Monthly treatment plant sampling (January 2007 through December 2007)
- Recording of daily average treatment system flow rates (January 2007 through December 2007)
- FS-1 ETD system optimization project note
- Finalize the *Fuel Spill-1 2005 Hydrologic Assessment of Two Ecosystems of Concern Technical Memorandum*
- Finalize the *Draft 2005 EDB Cranberry Sampling and Analysis Technical Memorandum*

If you have any questions or comments, please contact Mike Minor at (508) 968-4670, extension 4672.

Sincerely,

CH2M HILL



Patricia de Groot, P.G., L.S.P.
Program Manager

Attachments:

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|------------------------------|---|
| Figure 1 | FS-1 Groundwater Plume and Treatment System |
| Figure 2 | FS-1 Chemical Monitoring Locations |
| Figure 3 | FS-1 Hydraulic Monitoring Locations |
| Figure 4 | FS-1 2006 Ethylene Dibromide Detections |
| Table 1 | FS-1 Well Construction and Surface Water Sampling Location Information |
| Table 2 | Groundwater Monitoring Results |
| Table 3 | Surface Water Monitoring Results |
| Table 4 | Hydraulic Monitoring Results |
| Table 5 | FS-1 Meeting Presentations |
| Table 6 | FS-1 Treatment Plant Sampling Results |
| Table 7 | FS-1 Treatment System Flow Rates |
| Table 8 | Treatment System Downtime Summary |
| Table 9 | FS-1 Treatment System Mass Removal Summary |
| Attachment A | Comparison of Detected Concentrations in FS-1 Groundwater and Surface Water to Applicable Groundwater and Surface Water Standards |
| Attachment B | FS-1 2006 SLR Data Summary Report |
| Attachment C | FS-1 Project Notes |

Enclosures: (1 unbound, 7 unbound, 7 CDs)

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|---|--|
| c: Mike Minor, AFCEE (1) | David Williams, DPH (1 CD) |
| Rose Forbes, AFCEE (1) | Steven Solbo, Jr., Mashpee Conserv. (2) |
| Melvin Alli, AFCEE/ICA/COR (1 CD) | Glen Harrington, Mashpee BH (1 CD) |
| AFCEE/MSCD (1 CD) | Steve Hurley, MDFW (1 CD) |
| HSW/PKVB (1 w/o attach.) | Jeff Lafleur, Cape Cod Cranberry Growers Assoc. (1 CD) |
| Paul Marchessault, EPA (1 bound, 1 CD) | Phil Brady, MA Div. of Marine Fisheries (1 CD) |
| Leonard Pinaud, MassDEP (1 bound, 1 CD) | Bill Fisher, Haley & Aldrich (1) |
| Peter Golonka, GF (1 bound, 1 CD) | Brian Handy, Handy Cranberry Trust (1) |
| James Quin, EEG (1) | CH2M HILL Doc. Control & Distribution |
| Denis LeBlanc, USGS (1 CD) | |

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- ¹ AFCEE (U.S. Air Force Center for Environmental Excellence). 2007 (January). Project Note: *FS-1 Monitoring Network Optimization*. 337105-SPEIM-FS-1-PRJNOT-001. Prepared by CH2M HILL for AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, MA
- ² AFCEE (U.S. Air Force Center for Environmental Excellence). 2006 (December). *Fuel Spill-1 2006 Annual SPEIM Data Presentation (January through June 2006)*. 337105-SPEIM-FS-1-PRJNOT-002. Prepared by CH2M HILL for AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, MA
- ³ AFCEE (U.S. Air Force Center for Environmental Excellence). 2005 (June). *Final Fuel Spill-1 2004 System Performance and Ecological Impact Monitoring Report*. 324146-SPEIM-FS-1-ANRPT-001. Prepared by CH2M HILL for AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.
- ⁴ AFCEE (U.S. Air Force Center for Environmental Excellence). 2001 (December). *Final Fuel Spill-1 Wellfield Design Report*. AFC-J23-35S19902-M23-0005. Prepared by Jacobs Engineering Group Inc. for AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.
- ⁵ AFCEE (U.S. Air Force Center for Environmental Excellence). 2000 (April). *Final Record of Decision Area of Contamination FS-1*. Submitted by Hazardous Waste Remedial Actions Program. Prepared for AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.